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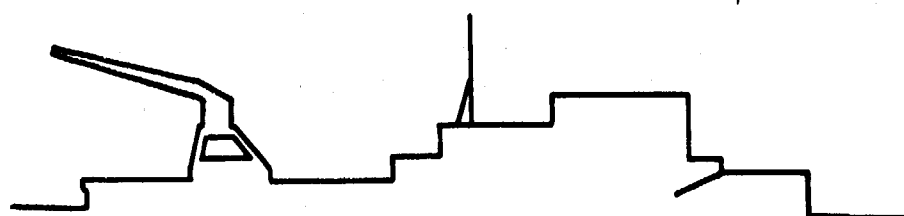
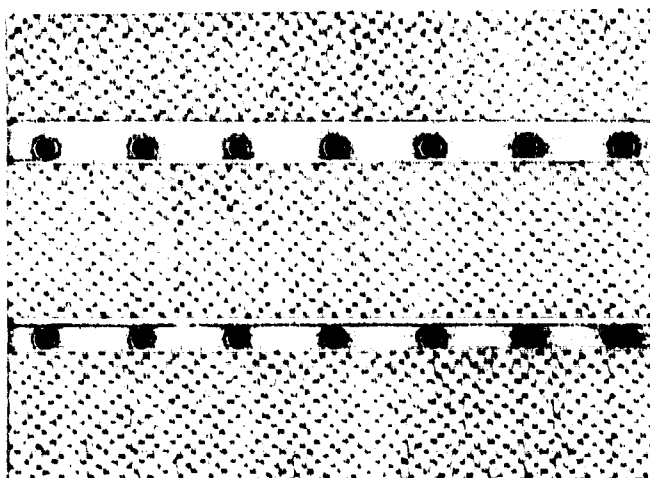


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# Ocean Engineering

CHESAPEAKE DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
WASHINGTON NAVY YARD  
WASHINGTON, DC 20374

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**Tracor Marine**



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**FINAL REPORT  
AUTEC SHALLOW WATER  
BATHYMETRIC SURVEY  
SITES 1 AND 2**

**Submitted to:**

**NAVAL FACILITIES  
ENGINEERING COMMAND**

**by**

**TRACOR MARINE, INC.**

**20 July 1983**

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## BLOCK 19 (Con't)

DESO-20 Fathometer System, a DECCA Model 540 Trisponder Navigation System and an Autocarta II Data Acquisition System with a remote Left/Right Display Unit and 20 inch DP-3 Plotter.

The survey work at Site 1 on July 4 consisted of positioning the 12 meter and 25/30 meter contours from High Cay to Calabash Bay, a distance of approximately 16 nautical miles. Using Sites 1 and 2 for navigation proved inadequate close to shore and north of Site 1. As a result, a third Trisponder station was established on High Cay. Three areas of interest were observed in the July 4 data, and these areas were developed at 50 meter crossline intervals on July 5. The July 5 operations also included development runs at Site 2, Tracks 3 and 8, which were originally surveyed on May 31. On July 6 development was completed at Site 2, Track 6, with additional development completed at other Site 2 areas. The remainder of the day was involved in data processing and disestablishment of the navigation stations. Aside from the navigation problems/delays on July 4 and the failure of the DP-3 plotter on July 5 (which was replaced on July 6), no other major difficulties were encountered in the conduct of this survey, and the project was completed on schedule. Throughout this survey, the winds were typically 15 knots from the southeast with waves running three feet. The purpose of this document is to present technical information on the procedures used by Tracor Marine to conduct the survey and to reduce the data.

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As a follow-on to deep water bathymetric surveys conducted at AUTEC Sites 1, 2 and 7 during May-July 1983, Tracor Marine conducted precision shallow water surveys at Sites 1 and 2 during July 1983. Using the LCM 75 as a survey platform, the survey equipment consisted of a Krupp-Atlas-Elektronik (Con't)

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**Tracor Marine**



**FINAL REPORT**  
**AUTEC SHALLOW WATER BATHYMETRIC SURVEY**  
**ANDROS ISLAND, BAHAMAS**  
**SITES 1 AND 2**

**Submitted to:**

**Naval Facilities Engineering Command**  
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**Washington, DC 20374**

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**20 July 1983**

**Approved:**



**Edward Clausner**  
**Vice President**

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1.0

### SUMMARY

As a follow-on to deep water bathymetric surveys conducted at <sup>Andros Island, Bahamas</sup> AUTECH Sites 1, 2 and 7 during May-June 1983, ~~Tracor Marine~~ <sup>were conducted</sup> conducted precision shallow water surveys at Sites 1 and 2 during July 1983. Using the LCM 75 as a survey platform, the survey equipment consisted of a Krupp-Atlas-Elektronik DESO-20 Fathometer System, a DECCA Model 540 Trisponder Navigation System and an Autocarta II Data Acquisition System with a remote Left/Right Display Unit and 20 inch DP-3 Plotter.

The Tracor Marine Survey Team consisted of Dr. Lanny Yeske, Project Manager, and Mr. Dallis Copeland, Navigation/Acoustic Technician. Navy representatives included Mr. Phil DeNolfo, NUSC-New London, and Mr. Ernie Joyal, NUSC-West Palm Beach.

The <sup>g</sup>survey work at Site 1 on July 4 consisted of positioning the 12 meter and 25/30 meter contours from High Cay to Calabash Bay, a distance of approximately 16 nautical miles. Using Sites 1 and 2 for navigation proved inadequate close to shore and north of Site 1. <sup>so</sup>As a result, a third Trisponder station was established on High Cay. Three areas of interest were observed in the July 4 data, and these areas were developed at 50 meter crossline intervals on July 5. The July 5 operations also included development runs at Site 2, Tracks 3 and 8, which were originally surveyed on May 31 (see Tracor Marine Final Report dated 10 June 1983). On July 6 development was completed at Site 2, Track 6, with additional development completed at other Site 2 areas. The remainder of the day was involved in

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data processing and disestablishment of the navigation stations. Aside from the navigation problems/delays on July 4 and the failure of the DP-3 plotter on July 5 (which was replaced on July 6), no other major difficulties were encountered in the conduct of this survey, and the project was completed on schedule.

Throughout this survey, the winds were typically 15 knots from the southeast with waves running three feet. The purpose of this document is to present technical information on the procedures used by Tracor Marine to conduct the survey and to reduce the data. The following deliverables were given directly to NUSC representatives on July 6/7:

*Survey Deliverables included:*

- Original Bathymetric Analog Records;
- Original Data Acquisition Record Printouts;
- Developed Sounding Sheets at 1:5,000 scale for each area surveyed;
- Developed Vessel Track Sheets at 1:5,000 scale for each area surveyed;
- Developed Sounding Sheets at 1:1,080 scale for selected areas of interest;
- Developed 1:1 scale Vertical Profiles of various sounding runs at Sites 1 and 2.

In accordance with NUSC discussions, the original magnetic data tapes collected during this survey have been retained by Tracor Marine and are available for further data reduction/refinement as desired.



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### 2.0 EVENT LOG

28 June 1983	Conducted initial technical discussions with NUSC.
29 June 1983	NAVFAC/NUSC Tasking.
3 July 1983	Personnel and equipment arrive AU/TEC at 1100. Installed Trisponder remote transmitter/receiver and directional antennas at Sites 1, 2 and 3. Completed loading of equipment on LCM 75. Equipment tested satisfactorily.
4 July 1983	LCM 75 underway 0800 for Site 1 operations. At sea buoy unable to consistently lock on Trisponder at Site 2. Trouble diagnosed as probable land blockage of line of sight transmission when close to shore at Site 1 as all computer diagnostic tapes indicated proper operation. Decision made to recover Trisponder from Site 3 and reinstall on High Cay. Received Site 3 transmitter/receiver at 1130. From 1210 to 1308 positioned the 30 meter contour from south of Site 1 to High Cay using Sites 1 and 2 with adequate navigation control.

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From 1330 to 1530 established navigation control point on the High Cay navigation light tower. Position established using master transmitter/receiver and Model 540 Distance Measuring Unit with ranges from Sites 1 and 2. Once positioned, replaced master transmitter/receiver with remote transmitter/receiver recovered by helicopter from Site 3.

Experienced normal three station navigation operation and from 1529 to 1650 positioned the 12 meter contour from High Cay north to Calabash Bay. From 1653 to 1701 positioned the 30 meter contour south from Calabash Bay. However, owing to slope steepness and sea conditions shifted to positioning of the 25 meter with operations terminating at 1812 near the Site 1 sea buoy.

5 July 1983

LCU 75 underway 0745 for operations at selected areas of interest as determined from analysis of July 4 data. From 0841 to 0940 ran 50 meter interval NE-SW development lines at position approximately one-half mile north of the Site 1 sea buoy.

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From 1010 to 1120 positioned remainder of 25 meter contour from Site 1 sea buoy south. From 1223 to 1257 completed NE-SW 50 meter interval developed lines at position approximately two miles south of the Site 1 sea buoy. From 1325 to 1334 completed development approximately one quarter mile north of High Cay.

Recovered remote transmitter/receiver from High Cay 1300 to 1400. Transit to Site 2 from 1400 to 1600. Offloaded remote transmitter/receiver for subsequent helicopter transfer and installation at Site 3. DP-3 plotter malfunction. Replacement unit ordered from Fort Lauderdale with delivery scheduled for 0800 following morning. At 1800 underway for development runs at Site 2, Tracks 3 and 8. Completed operations at 1905 with normal navigation from Sites 1, 2 and 3.

6 July 1983

LCM 75 underway 0810 for continued Site 2 operations. From 0833 to 0853 conducted E-W development runs at Track 6. From 0903 to 0940 completed E-W tracks at other areas of interest. At 1000 returned to Site 2 and received replacement DP-3 plotter. From 1040 to

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1230 LCM 75 transit to Site 1 with data processing in progress. Completed data processing at 2200.

7 July 1983	Vessel demobilization. Tracor Marine personnel and equipment return to West Palm Beach at 1700. Final report preparation continues.
13 July 1983	Discussions on draft final report with NUSC in West Palm Beach.
20 July 1983	Final report and analysis forwarded to NAVFACENGCOM with copies to NUSC-New London and West Palm Beach.



### 3.0 NAVIGATION

The Tracor Marine supplied Decca Model 540 Trisponder System and Autocarta II Data Acquisition System with helmsman's Left/Right Indicator were used to position the LCM during survey operations. As shown in Figure 1, for the survey at Site 1, Trisponder antennas were located at Sites 1, 2 and High Cay. For the survey at Site 2, antennas were installed at Sites 1, 2 and 3. Geographic positions, antenna heights and Universal Transverse Mercator coordinates for the shore NAVAIDS sites are given in Table 1. The ship's Trisponder antenna was located within one meter of the DESO-20 transducer position.

According to the manufacturer, the accuracy of the Model 540 Trisponder System is typically  $\pm 1$  meter. Because precise geodetic coordinates for High Cay were not available, the antenna location was determined using the Trisponder itself and is also subject to an error of  $\pm 1$  meter. Similarly, the Trisponder antenna was located approximately 2 meters from the alleged reference point on the Site 2 radar tower. In the unlikely event of all errors being additive, the maximum position error for Site 1 operations is  $\pm 4$  meters and  $\pm 3$  meters for Site 2 operations. If desired, High Cay could be surveyed and corrections applied to the Site 2 antenna location to reduce the overall error to  $\pm 1$  meter.

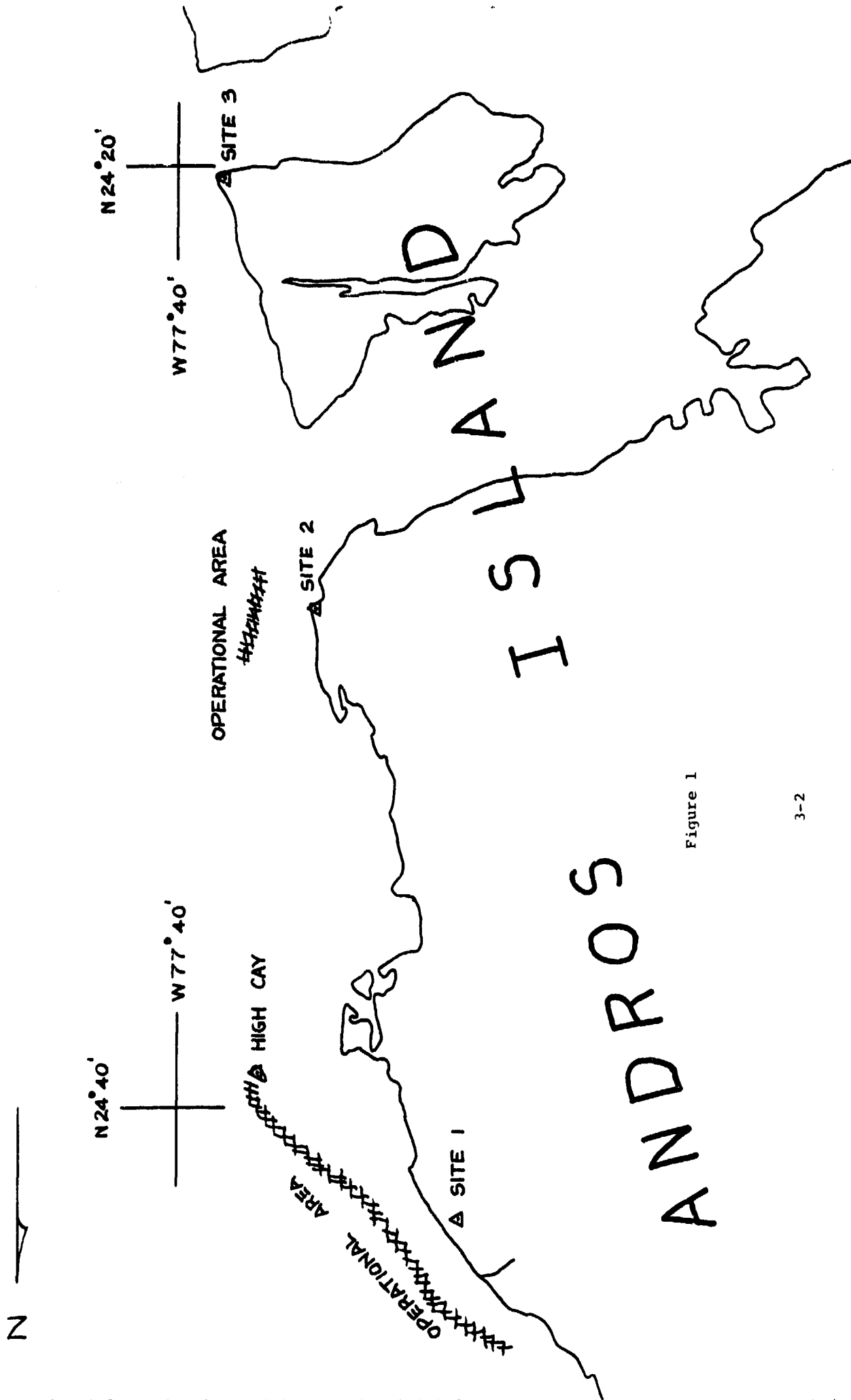


Figure 1

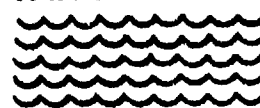
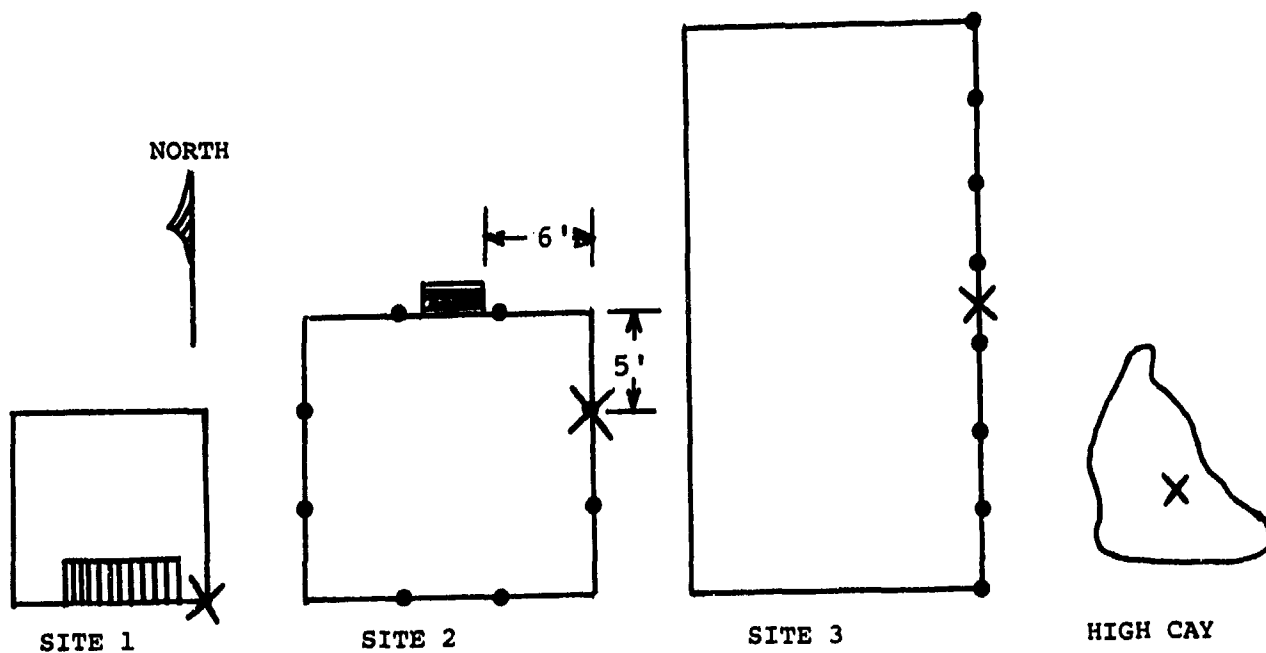


TABLE 1

AUTEC ANTENNA LOCATIONS

Site 1	N24° 42' 20.97"	N 2,735,041.749
	W77° 45' 54.89"	E 220,223.007
	HT = 90' = 27.4 m	
Site 2	N24° 29' 53.97"	N 2,711,958.265
	W77° 43' 10.55"	E 224,389.325
	HT = 66.3' = 20.2 m	
Site 3	N24° 20' 17.0743"	N 2,694,131.454
	W77° 40' 59.9682"	E 227,723.084
	HT = 60' = 18.3 m	
High Cay	N24° 38' 53.33"	N 2,728,511.14
	W77° 41' 45.56"	E 227,107.91
	HT = 35' = 10.7 m	





#### 4.0      SOUNDINGS

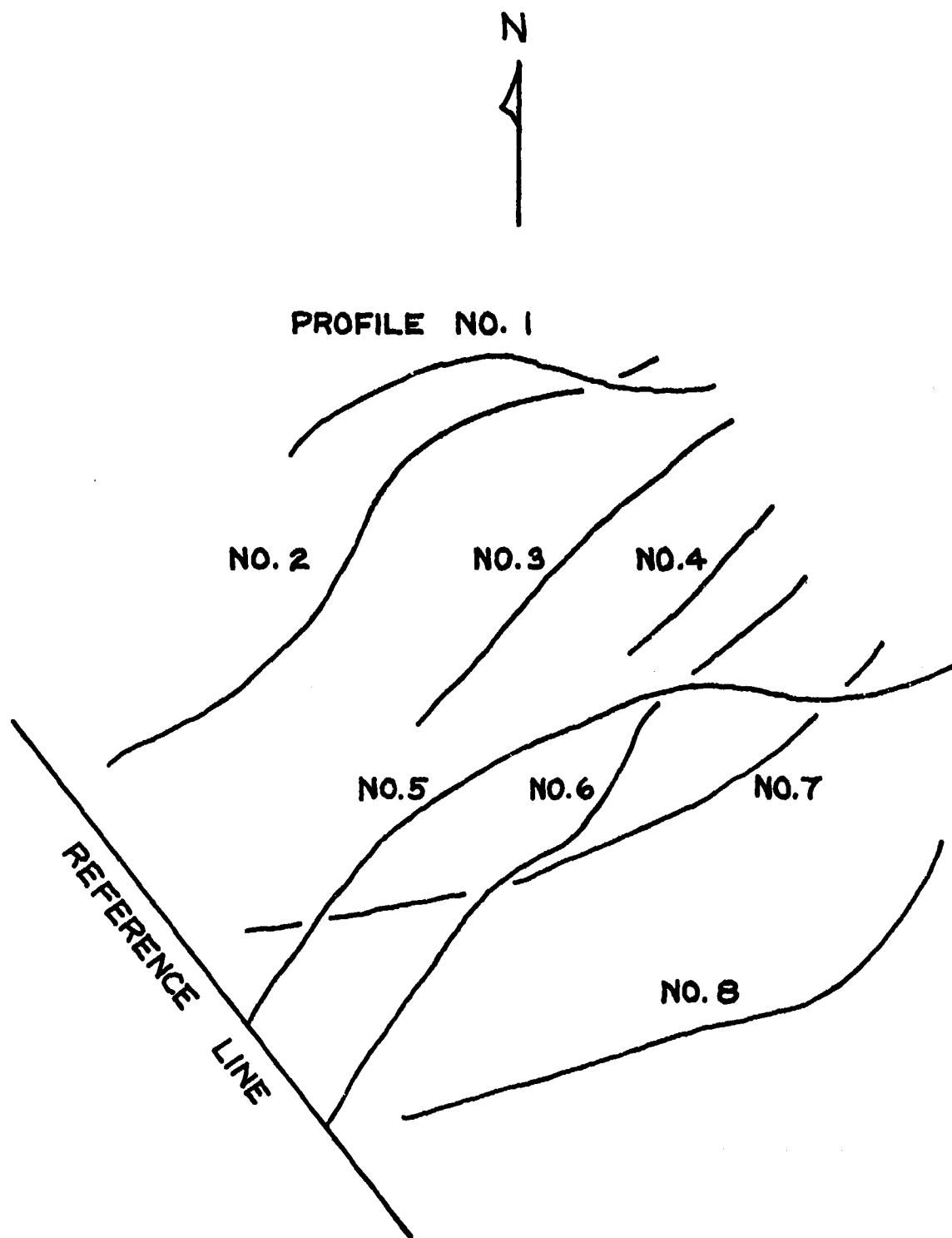
Soundings were taken with a Krupp-Atlas Elektronik DESO-20 Bathymetric System, supplied by Tracor Marine. A Raytheon Model 719C Fathometer System was also provided as a back-up for the DESO-20, but was not used. Soundings were taken using both the 33 KHZ 18° beam and 210 KHZ 9° narrow beam transducers with the 210 KHZ sounding information digitized for subsequent plotting. The transducer was mounted over the side of the LCM at a fixed depth of 1.6 meters which is incorporated in the soundings on the smooth sheets. According to the manufacturer the precision of the DESO-20 using 33 KHZ is .12% of the depth plus 9.5 cm whereas for 210 KHZ the precision is .12% of the depth plus 1.5 cm.

Tidal corrections, ranging from 0 to 2 feet, were available but were not applied to the data in order to provide deliverables upon completion of the survey. If desired, these corrections could be applied at a later date.

At both Sites 1 and 2, it was feasible to compare soundings at principal line and crossline intersections and total agreement in soundings was observed. The DESO-20 soundings were also verified by hand lead line checks prior to commencement of the survey.

The DESO-20 performed well in depths of up to 100 meters. However, apparently due to the steep bottom slopes, at depths greater than 100 meters the digitizer could not accurately track the bottom.





SITE ONE PROFILES

Figure 2

# SITE 1 - PROFILE NO. 1

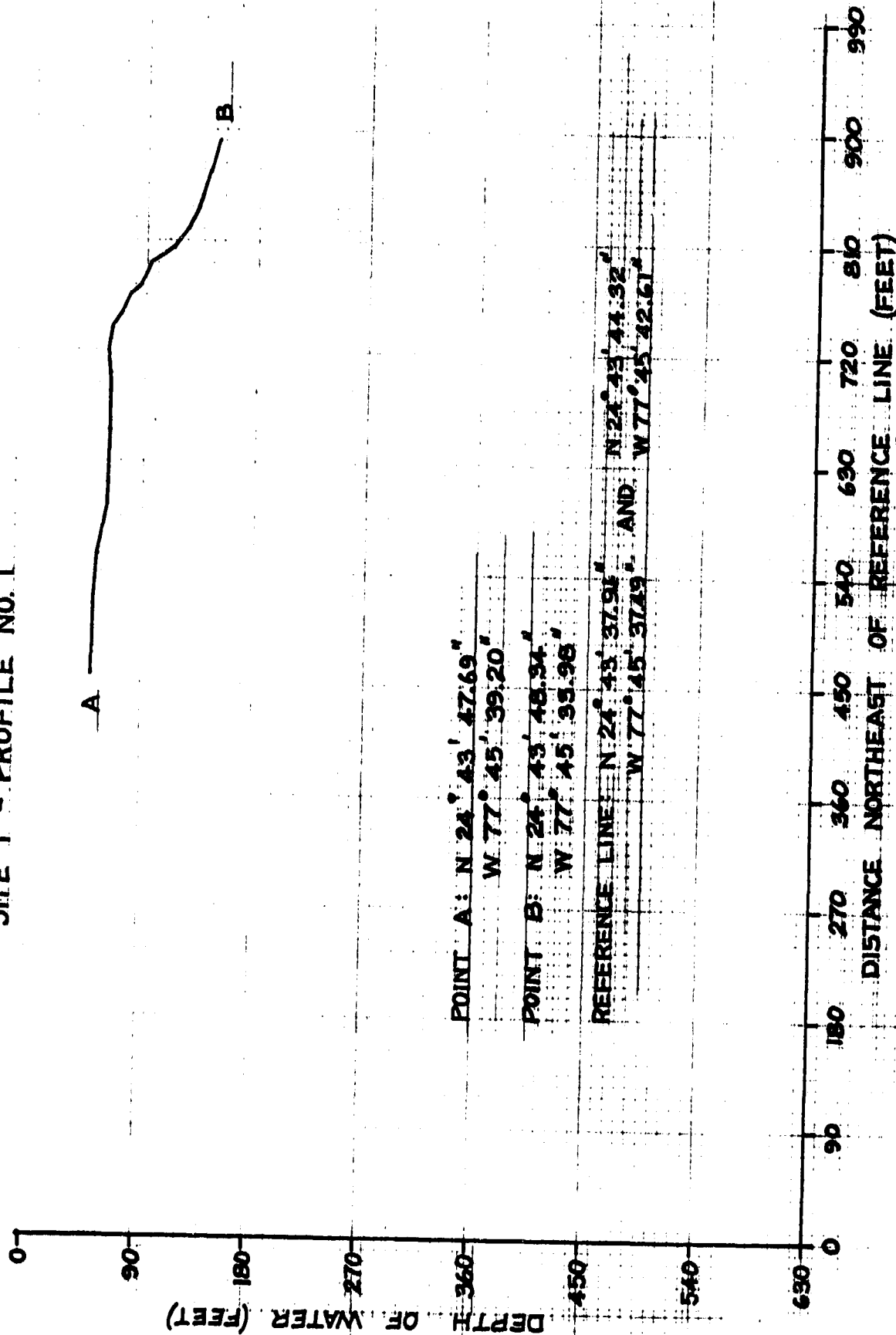


Figure 3 4-3

# SITE 1 -- PROFILE NO. 2

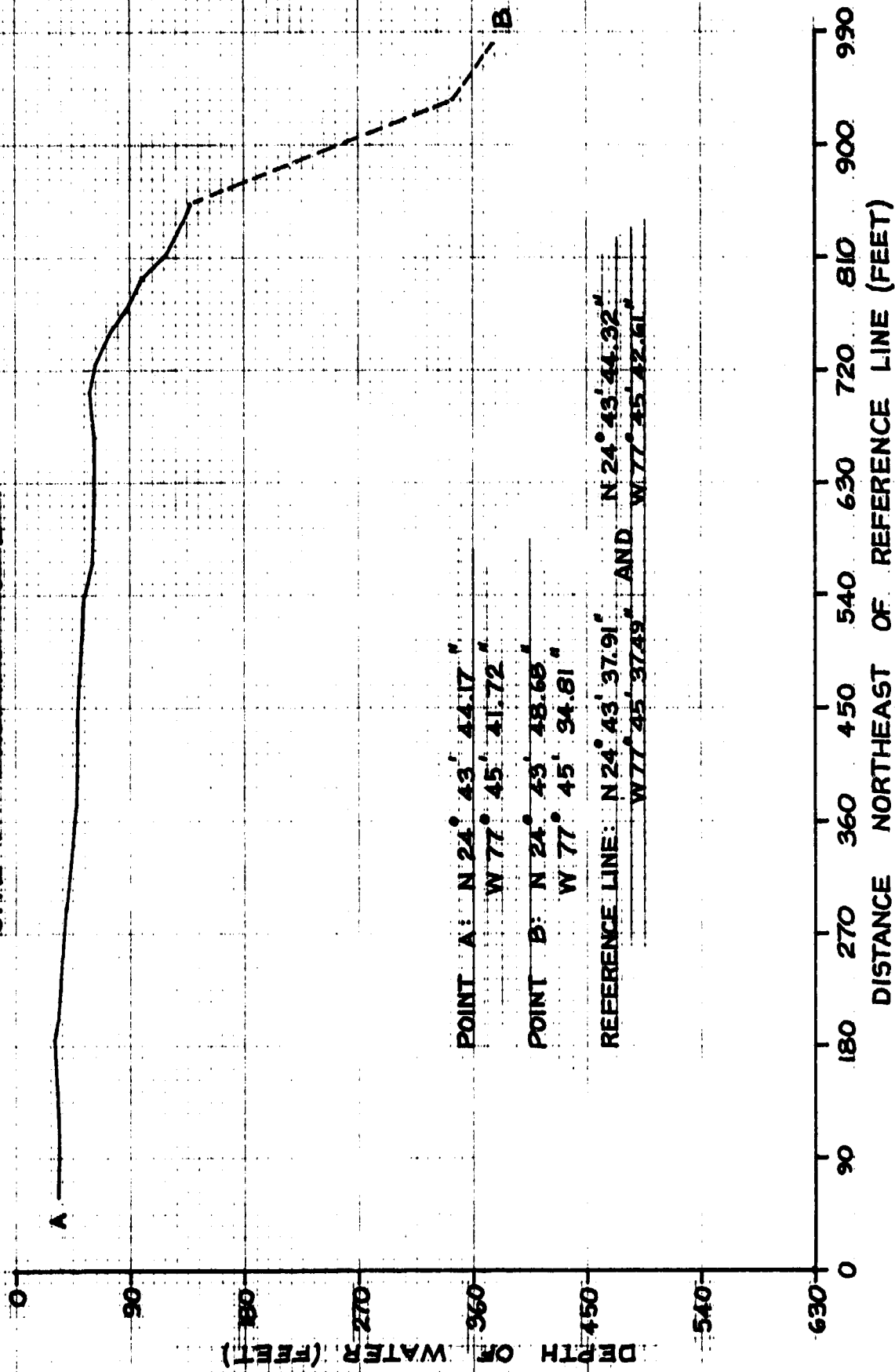


Figure 4 4-4

# SITE 1 - PROFILE NO. 3

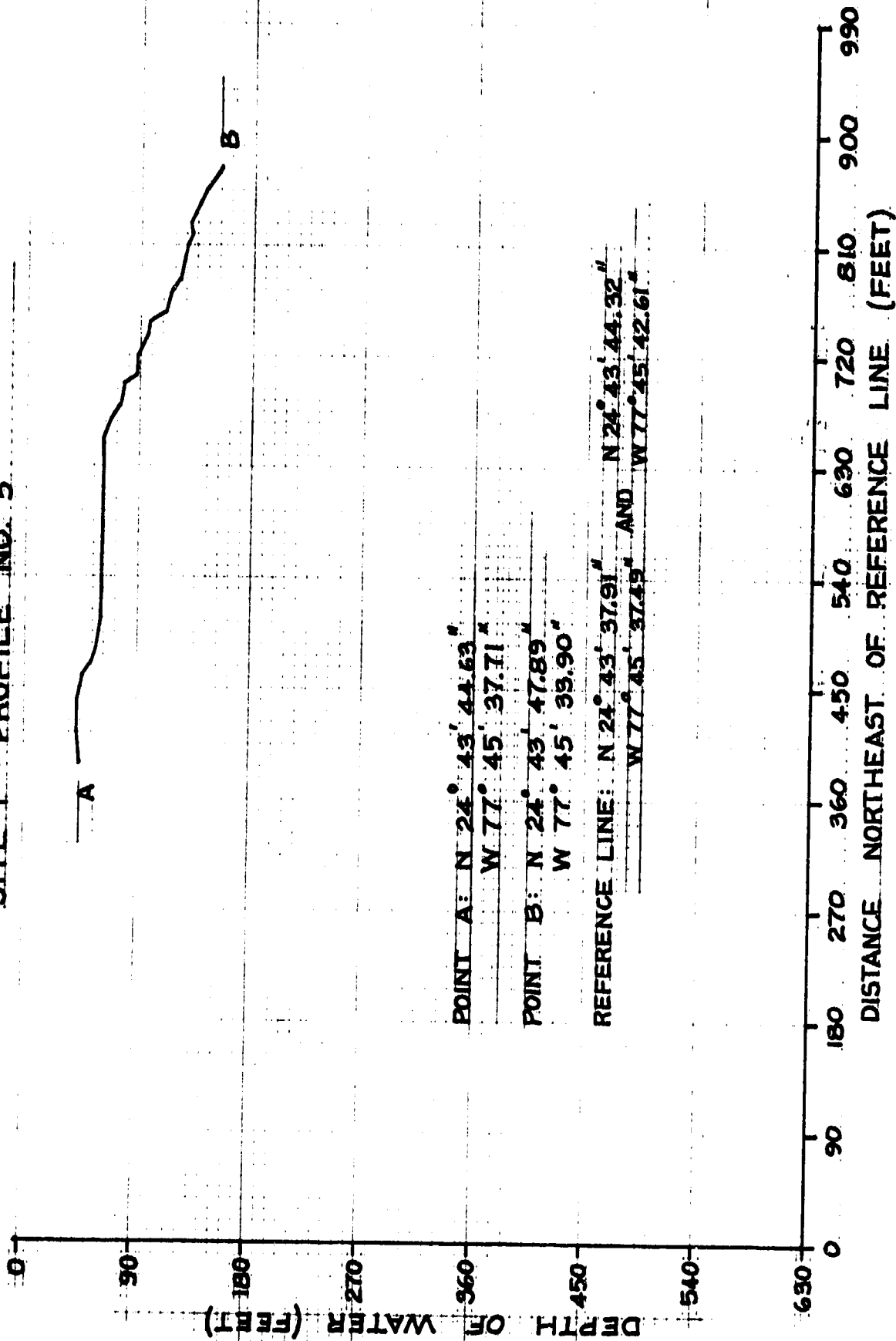


Figure 5 4-5

# SITE 1 - PROFILE NO. 4

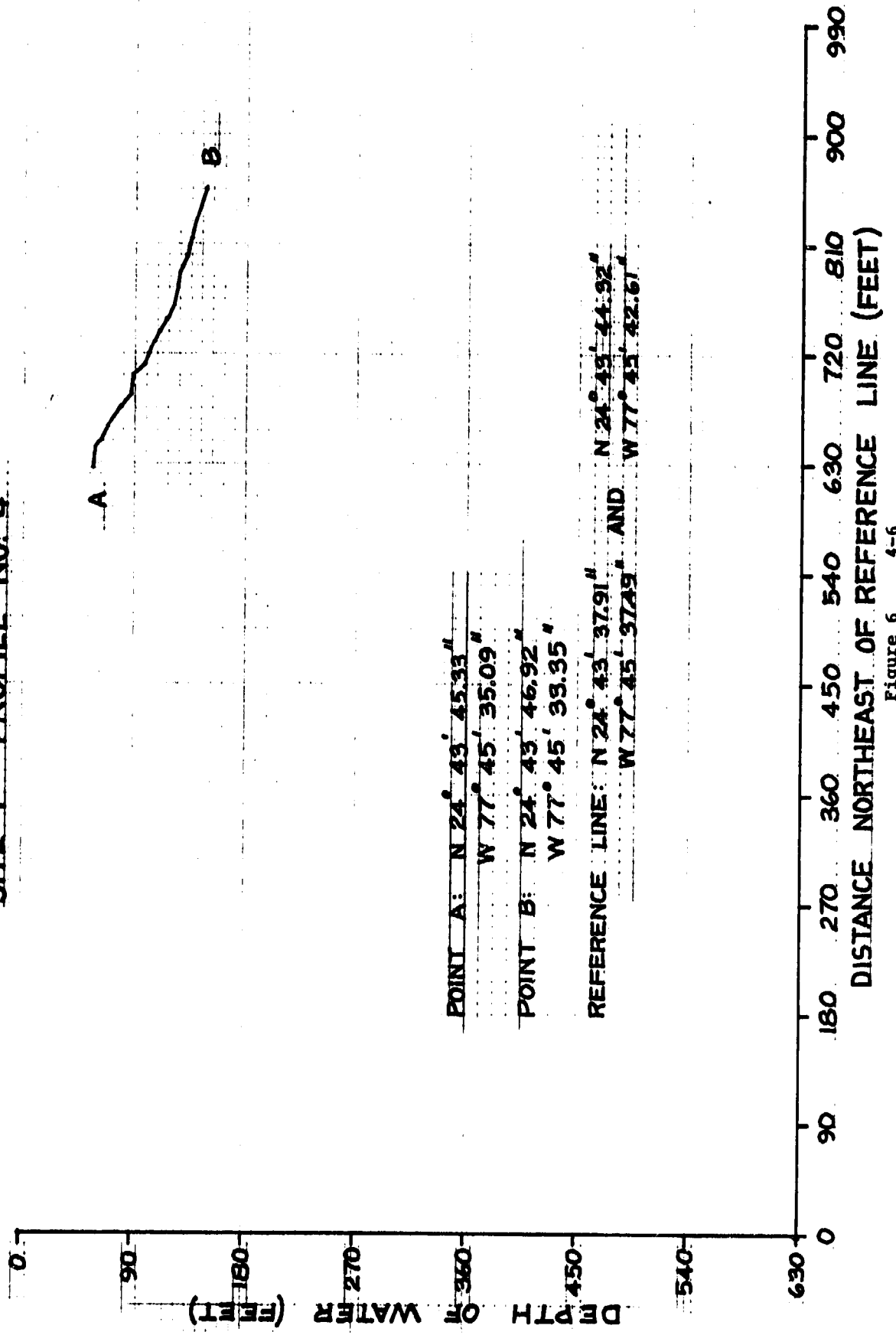


Figure 6 4-6

# SITE 1 -- PROFILE NO. 5

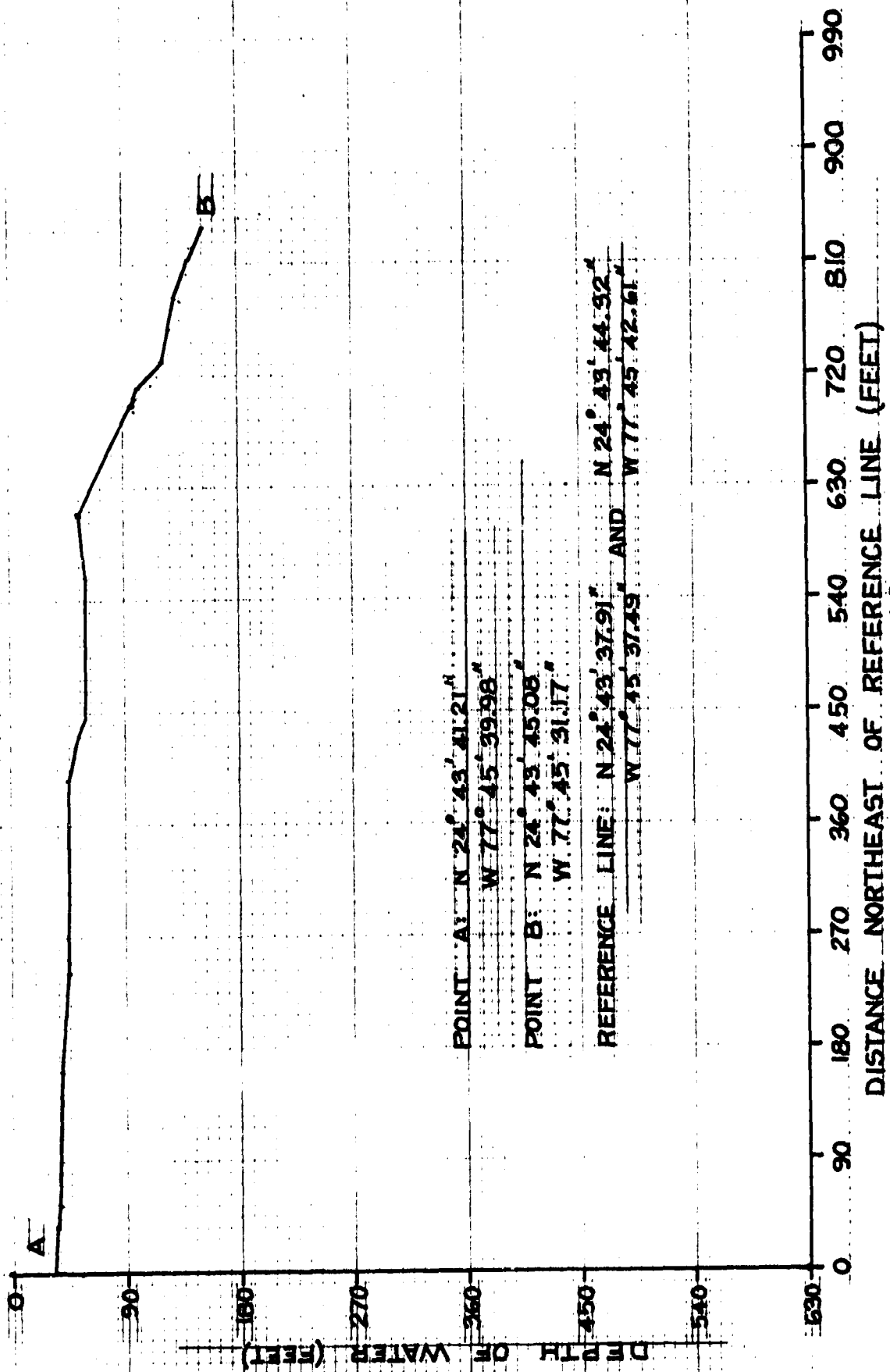


Figure 7 4-7

# SITE 1 - PROFILE NO. 6

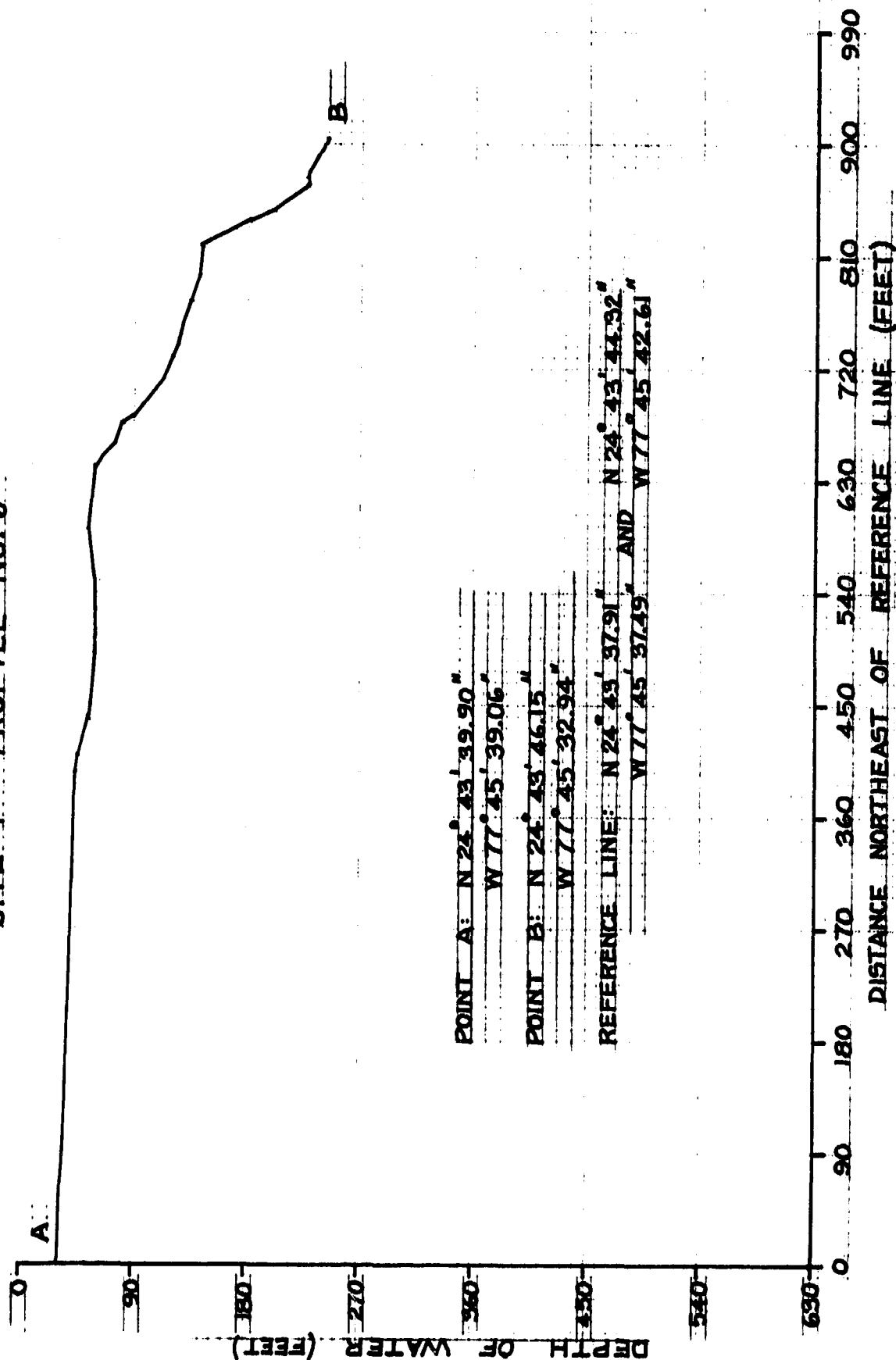
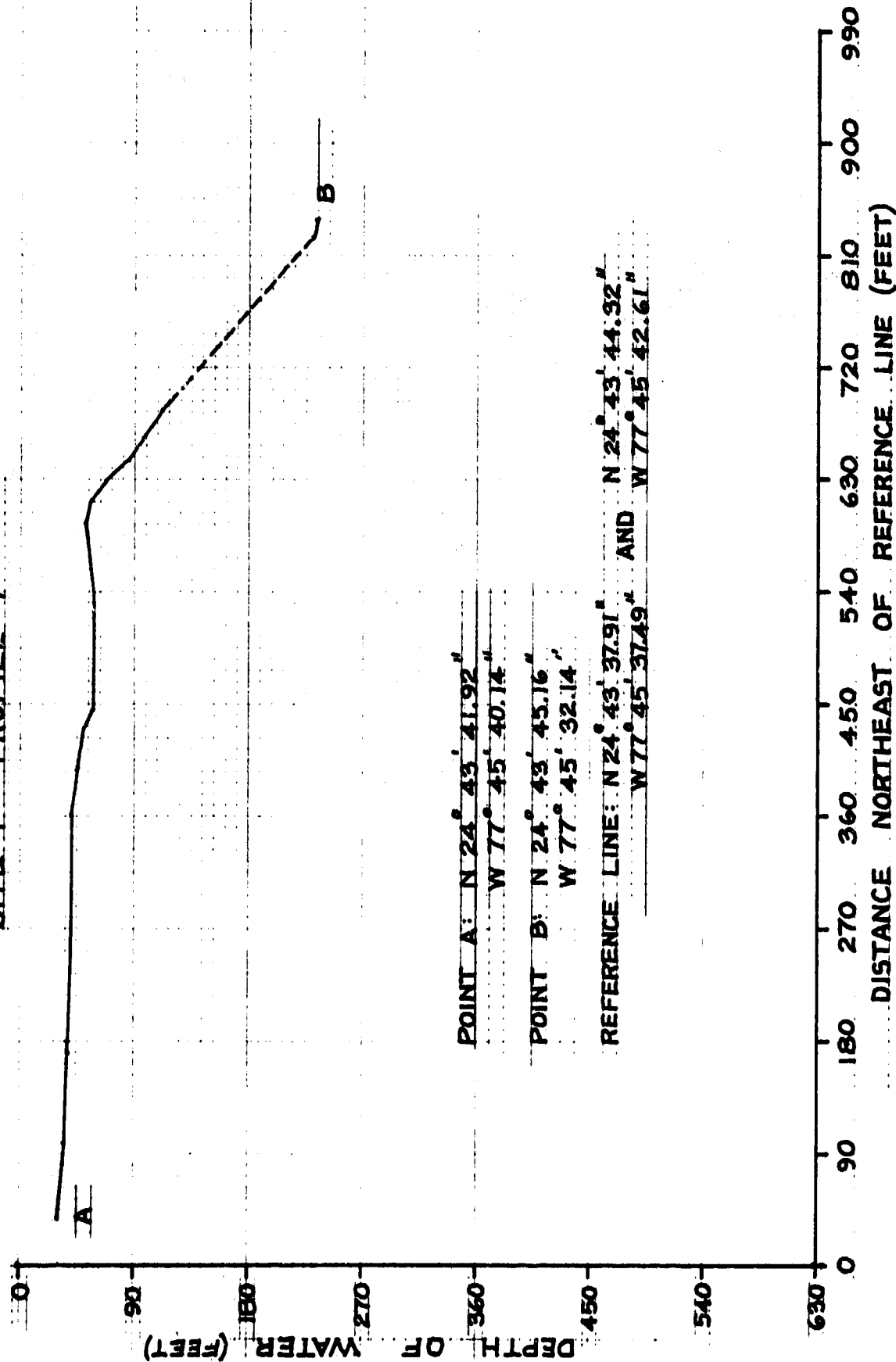


Figure 8 4-8

# SITE 1 - PROFILE 7





# SITE 1 - PROFILE NO. 8

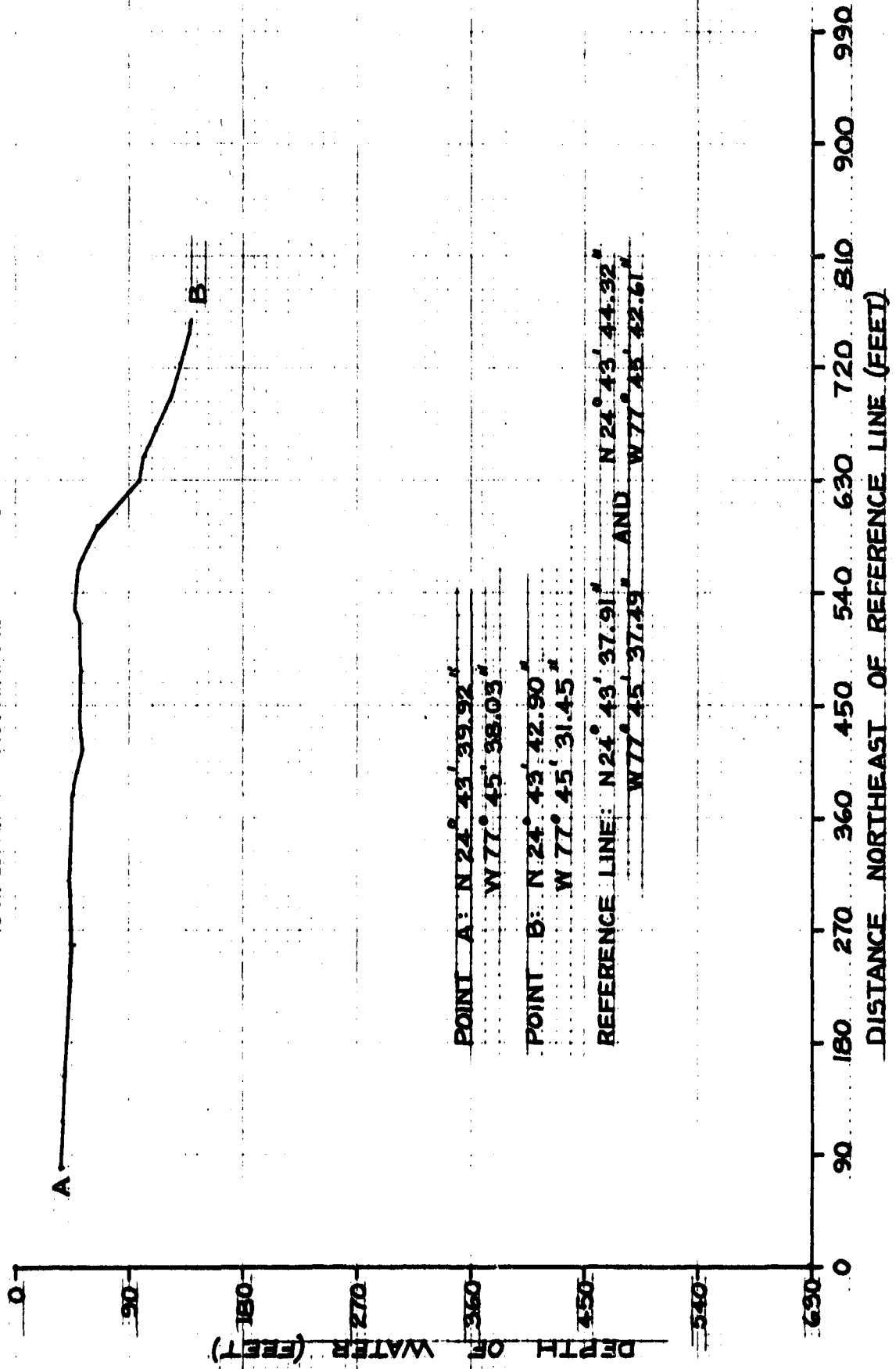
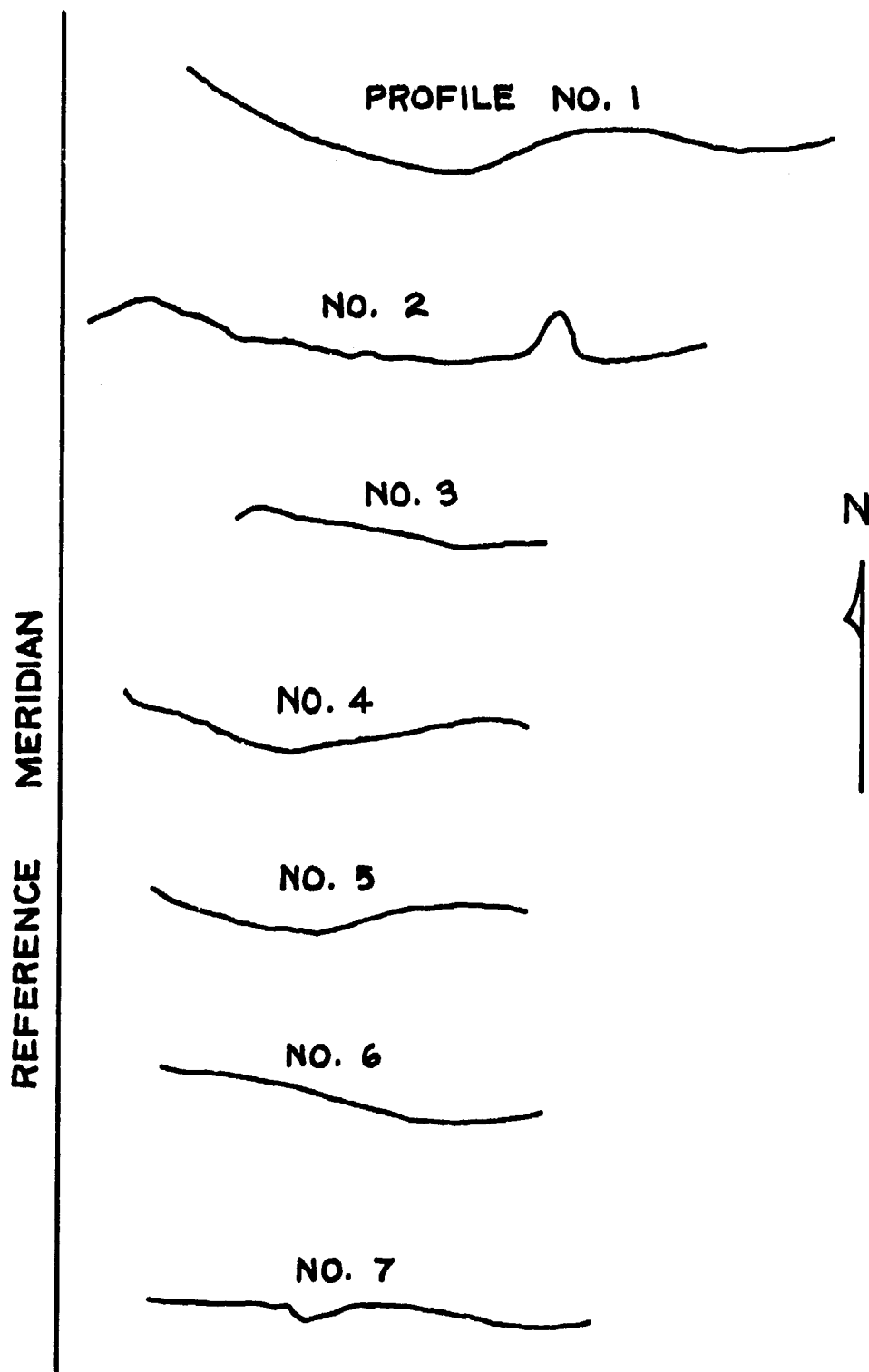


Figure 10 4-10



SITE TWO PROFILES

# SITE 2 - PROFILE NO. 1

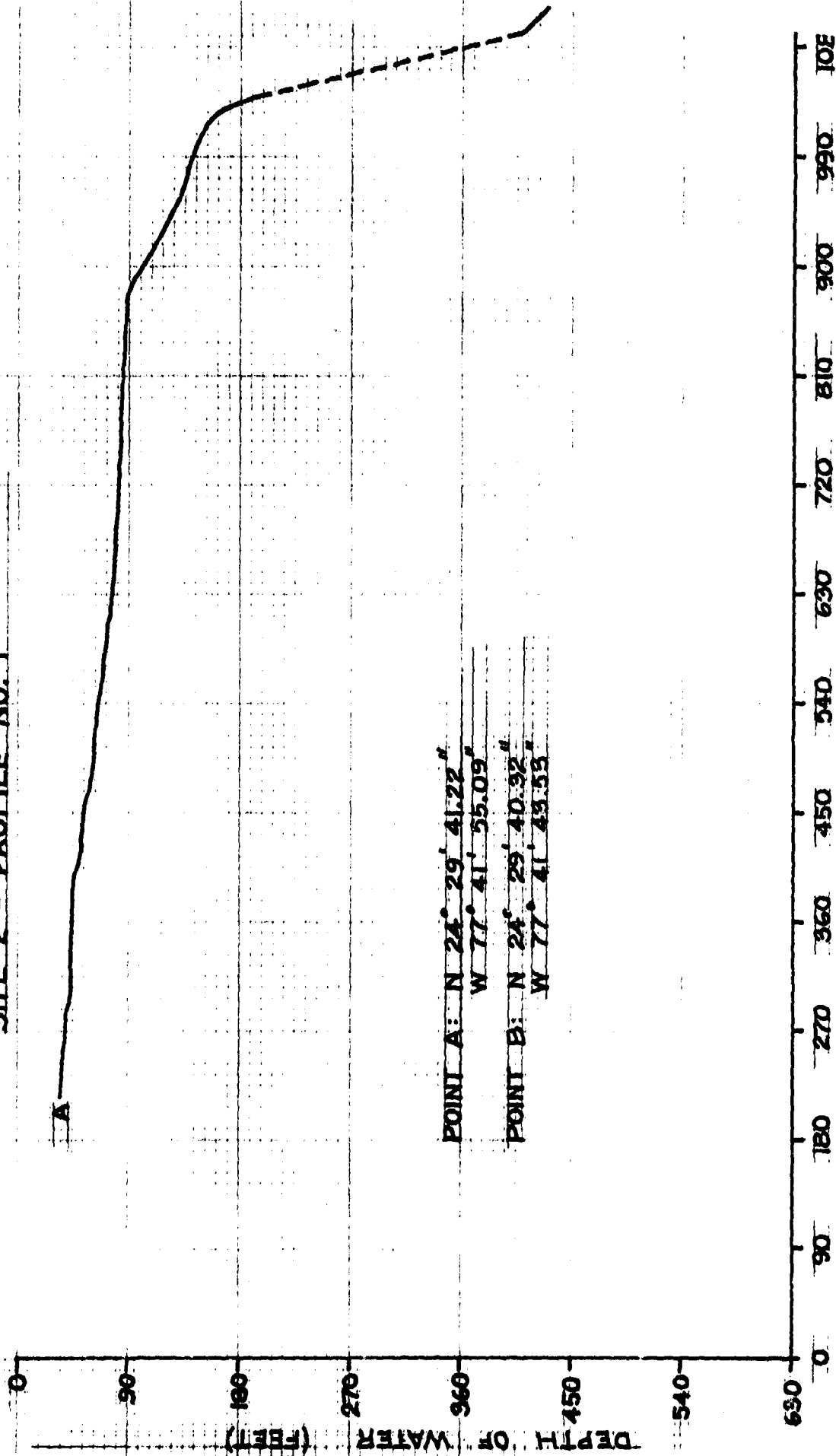


Figure 12

# SITE 2 - PROFILE NO. 2

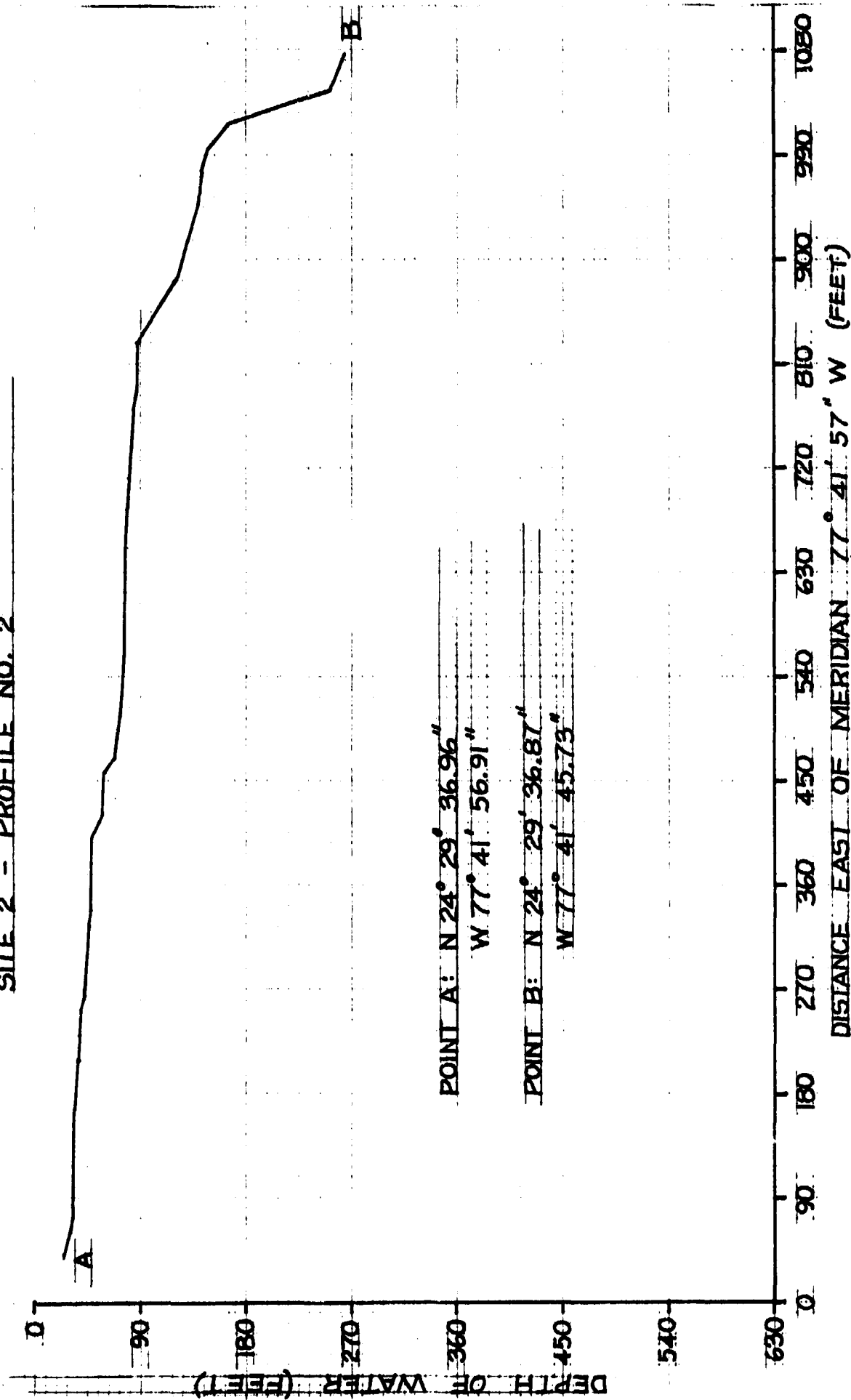
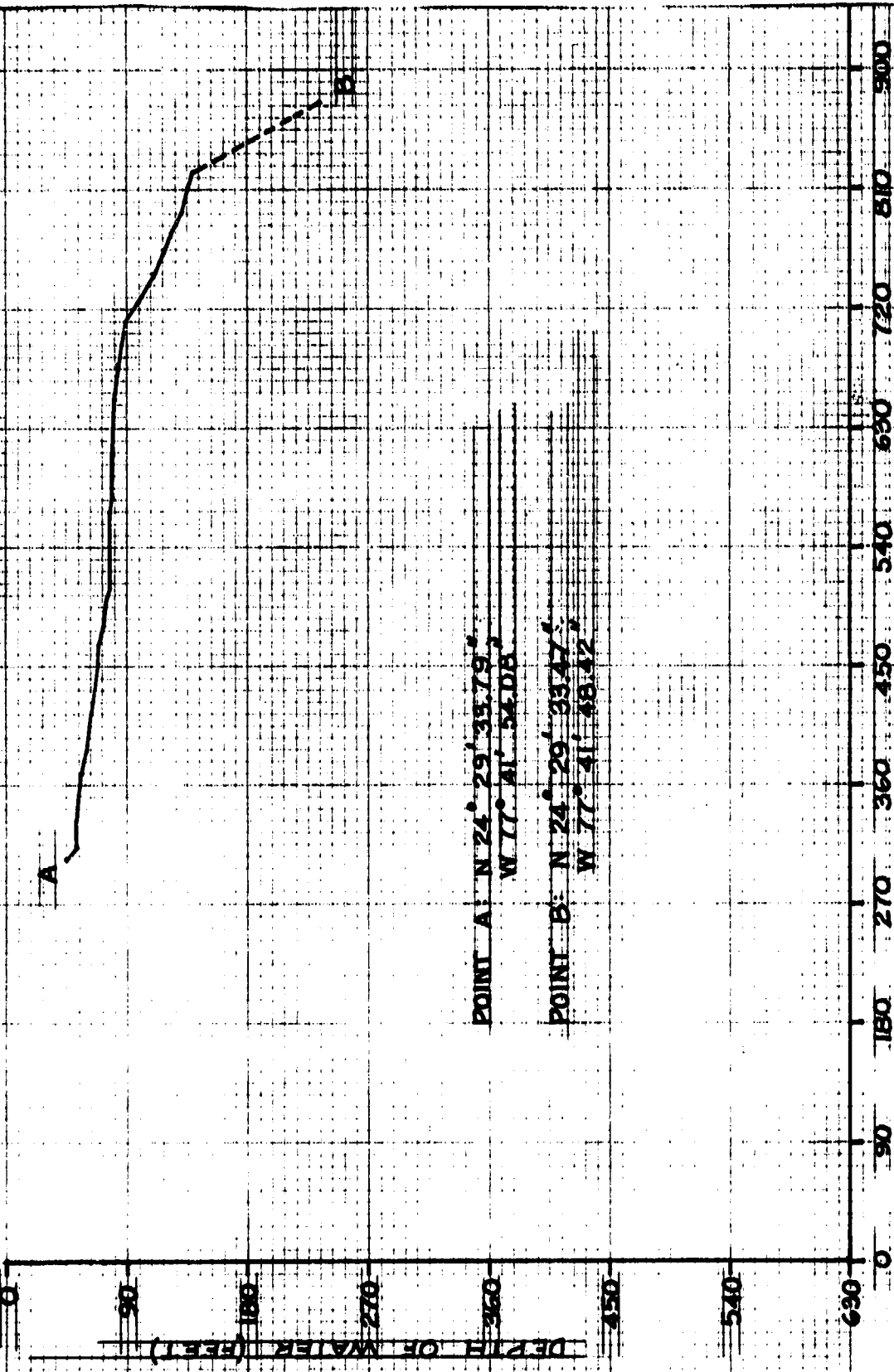


Figure 13 4-13

# SITE 2 - PROFILE NO. 3



DISTANCE EAST OF MERIDIAN 77° 41' 57" W (FEET)

Figure 14 4-14 75 0000 14

# SITE 2 - PROFILE NO. 4

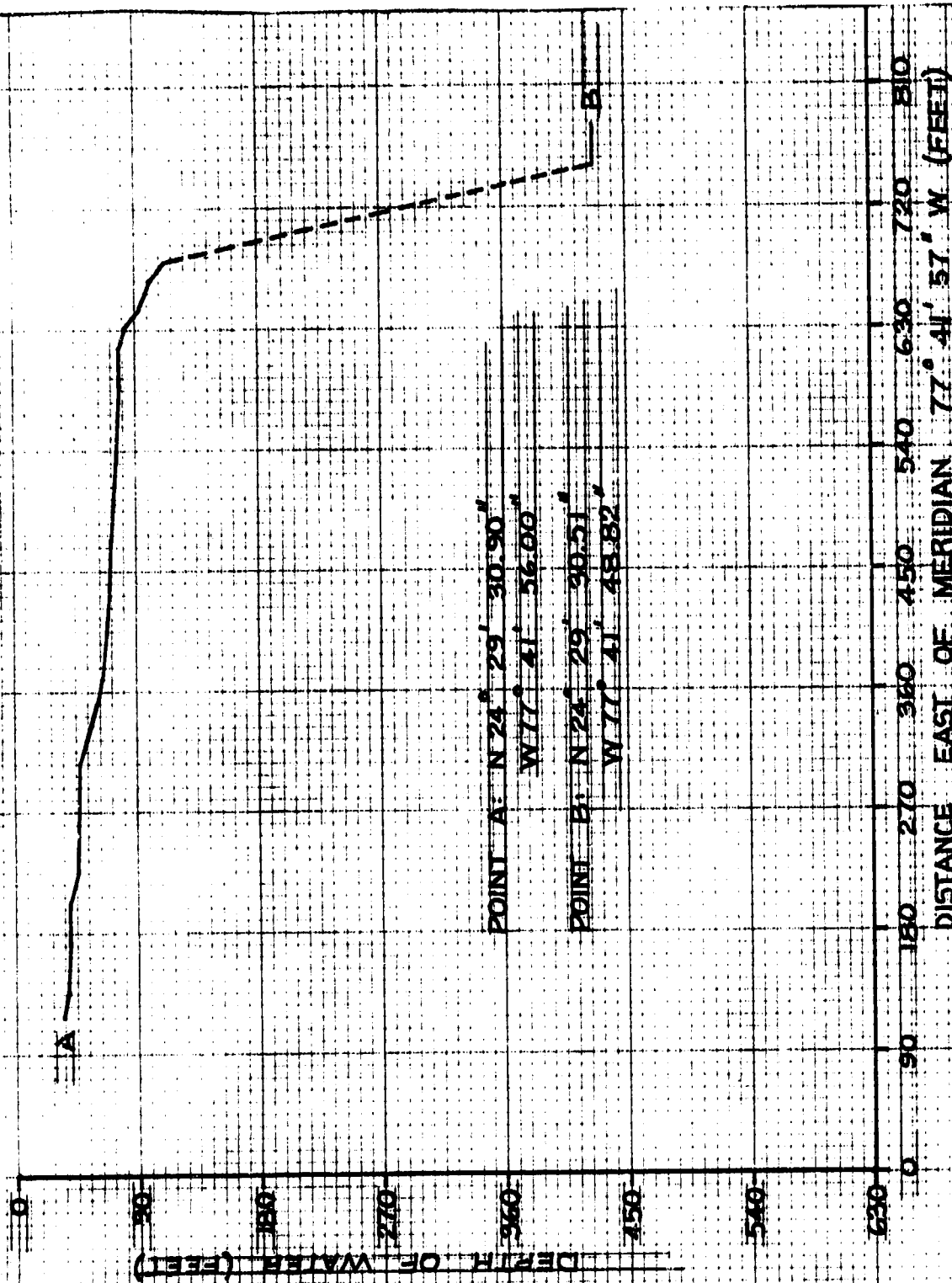


Figure 15

# SITE 2 - PROFILE NO. 5

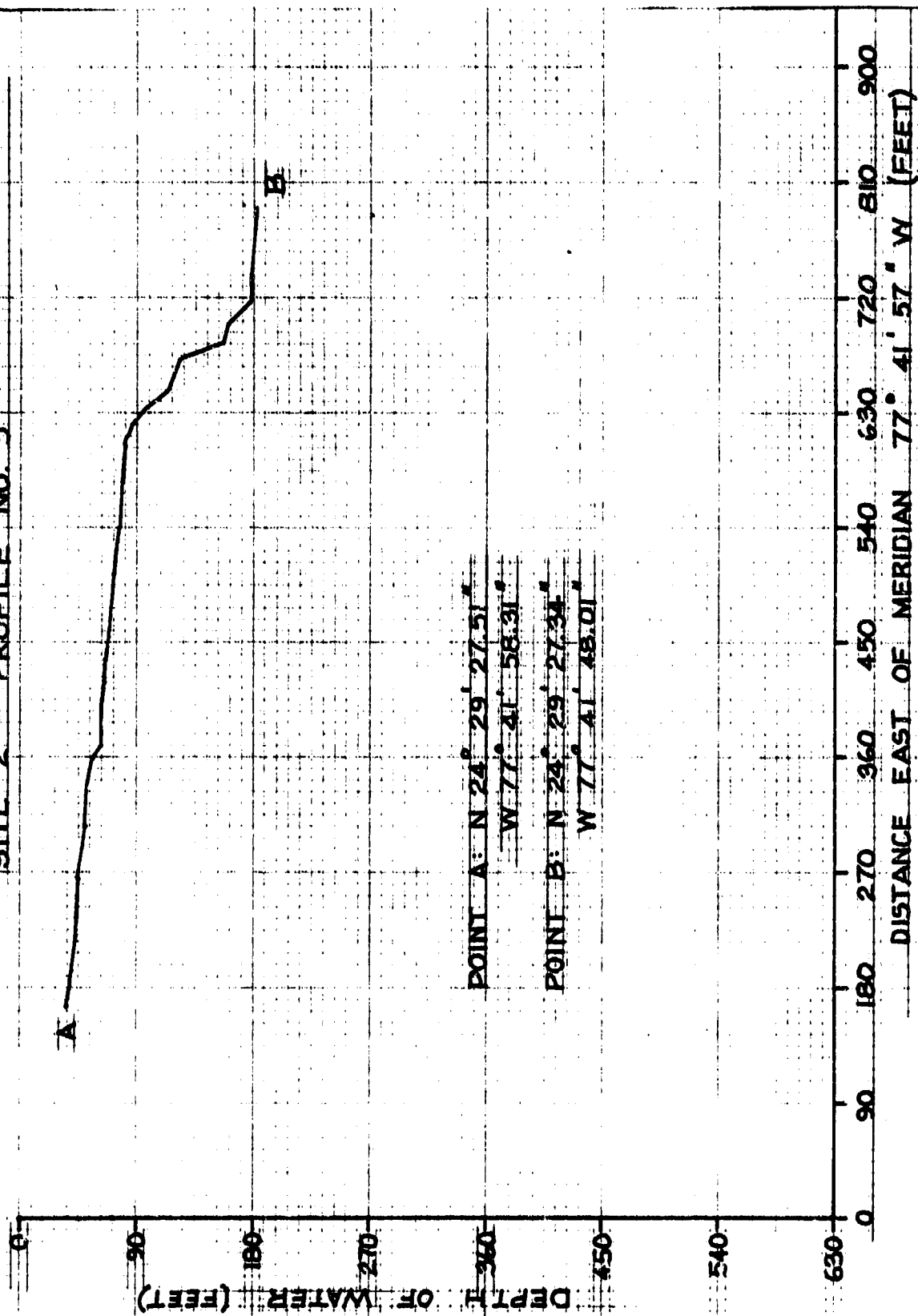


Figure 16

# SITE 2 - PROFILE NO. 6

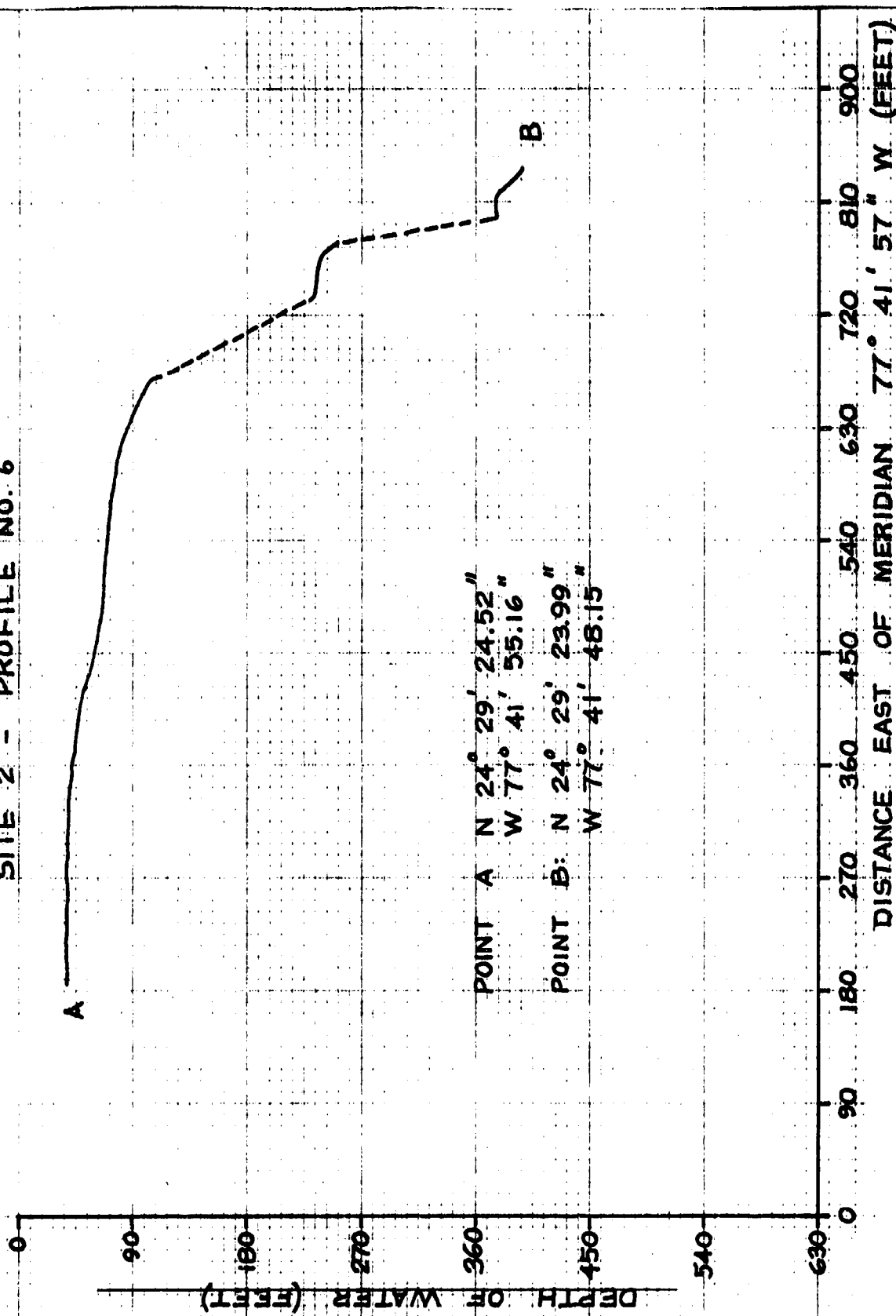


Figure 17



# SITE 2 - PROFILE NO. 7

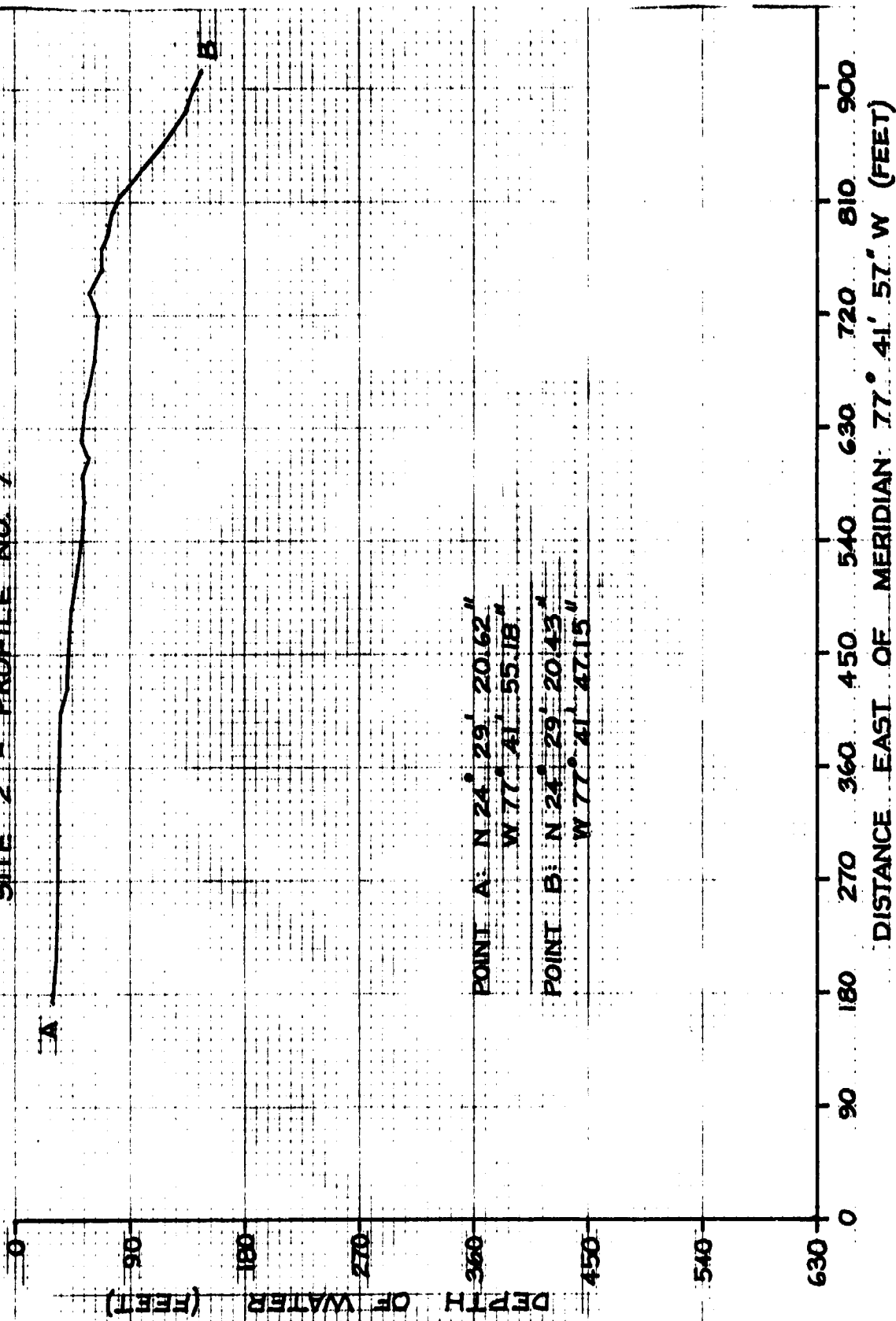


Figure 18 4-18



## 5.0 DATA PROCESSING AND DELIVERABLES

Soundings and track sheets are UTM projections using the Clarke 1866 Spheroid North American Datum of 1927. Sounding sheets were plotted at a scale of 1:5,000 although areas of interest were expanded to a scale of 1:1,080. All charting was accomplished using the Autocarta II and DP-3 20 inch plotter except for the profiles discussed below which were hand plotted.

Because of the requirement to provide deliverables immediately upon completion of the survey, it was not possible to edit the completed sheets for any soundings which may have been erroneously digitized. However, most erroneous soundings are clearly evident in the provided sounding sheets.

As a result of discussions with NUSC on 13 July 1983, 1 to 1 scale vertical profiles of various development runs are provided in this section. Figure 2 shows the general orientation of 8 profiles near Site 1 running in a NE-SW direction relative to a reference line oriented 325° T approximately paralleling the 30 foot contour. Figures 3 through 10 provide detailed profile information at Site 1.

Similarly, Figures 11 through 18 provide profile information at Site 2. This data is referenced to the W77°41'57" meridian as all profiles are generally in an E-W direction.



6.0      CONCLUDING REMARKS

We would like to express our sincere appreciation and gratitude to the numerous individuals from NUSC, RCA, LCM 75 and AUTECH, in particular Phil DeNolfo, Ernie Joyal, Joe Walker, Barry Dix, Dan Swann, Dave Newberg and Rich Hall who contributed significantly to this effort and its successful completion.